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CLAIMS

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[Claim(s)]

[Claim 1] The data I/O engine which has the data input output equipment which performs a print function, and the control section of this data input output equipment, The printing engine which has the control section of the airline printer which performs a copy function, and this airline printer, It has the image I/O engine which has the control section of the image I/O device equipment which performs image I/O functions, such as facsimile and filing, and this image I/O device. With each engine In the compound machine which offers various services, such as a print function, a copy function, and an image I/O function The compound machine characterized by preparing the bus switching control switched to the joint network formed of each interconnect between the system control section in said compound machine which realizes said various services, and said each control section for said every engine according to said various services.

[Claim 2] The compound machine according to claim 1 said whose bus switching control is a crossbar switch.

[Claim 3] The compound machine according to claim 1 said whose control section is equipment dynamically reconfigured according to said each service.

[Claim 4] The compound machine according to claim 3 with which said equipment reconfigured dynamically contains recon figure skating rubble logic.

[Claim 5] The compound machine according to claim 1 which said joint network consists of by optical bus.

[Claim 6] Said optical bus is a compound machine according to claim 5 used as a data bus which transmits image data.

[Claim 7] A compound machine according to claim 5 or 6 with the same specification of said optical bus.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] About a compound machine, this invention provides a detail with various services, such as a printer, a copy, facsimile, and filing, and relates to the compound machine using the bus switching control which switches a joint network to a high speed.

[0002]

[Description of the Prior Art] A compound machine (Multi Function Product: omit Following MFT) is equipment which makes it possible to realize various services, such as a print, a copy, facsimile, and filing, with one equipment by being constituted by each component, which are data input output equipment, an airline printer, and a picture input device, and combining them. There is a remarkable thing in the spread of office digitization or networks in recent years, and it is recognized that MFT has very high compatibility to such a trend. Moreover, the demand to the productivity drive of an office work piece is also becoming strong day by day. The shipment number of MFT is sharply extended reflecting the user who newly considers installation of MFT instead of independent devices, such as the conventional printer, a copying machine, and a scanner, under such a background having increased rapidly.

[0003] Conventionally, as shown in drawing 7, each control sections 731, 732, and 733 of the image I/O device of others, such as each component, which are data input output equipment 711, an airline printer 712, and image I/O device 713, data input output equipment which is an independent device, an airline printer, and a scanner, were diverted to development of such a control device of MFT as they were as equipment 71, i.e., an engine layer, before compound-izing. And various services of the image I/O function 723 of others, such as a print function 721, a copy function 722, facsimile, and filing, have been offered. Such a development approach which hardly changes to the case of an independent device did not have the need of newly developing the control unit for MFT, and the big problem was not produced when the need of MFT was still small.

[0004] The actuation in the case of using various services about the conventional MFT hereafter using drawing 8 which showed the conventional MFT structure of a system is explained briefly. In this drawing, the MFT system is constituted through the network 84 in MFT81 and the external memory sections 83, such as the host side PC 82 and hard disk drive equipment. According to the MFT system which has such a configuration, when using MFT81 as a printer first, the data outputted from the host side PC 82 are inputted into the data input output equipment 811 by the side of MFT81 through a network 84. The data which entered here are the data-input-output-equipment control section 812 of data input output equipment 811, and analysis of printer language, expanding of an image, etc. are performed and they are changed into raster data. Then, data are sent to the airline printer control section 814 of an airline printer 813, and image processings, such as color matching, are carried out, and, finally they are outputted as printed matter with an airline printer 813. Next, when using MFT81 as Copyer, according to conditions beforehand set up by the image I/O device control section 816 of image I/O device 815, such as resolution, and black and white/color, a document is read in image I/O device 815, and it is

changed into digital image data. After that, hard copy is outputted from an airline printer 813 via the same processing as printer actuation. Furthermore, when applying MFT81 as a filling system, image I/O device 815 generates digital image data first like the time of the Copyer actuation. The data is sent to the data-input-output-equipment control section 812 of data input output equipment 811, and compressive processing is performed. Finally data are transmitted to the external memory section 83 connected to the network 84 via data input output equipment 811, and filing of a document is completed. The above is the structure of the various service provisions performed in the conventional MFT.

[0005] By the way, to MFT, the request of colorization correspondence, improvement in the speed, low-pricing, high addition functionalization, power-saving, etc. is recently strongly brought near from the user. And it is thought that the development for the formation of MFT high performance will be accelerated further from now on.

[0006]

[Problem(s) to be Solved by the Invention] According to the above-mentioned conventional MFT, by having diverted the control section of an independent device and having developed MFT for every model combining them, reduction of development cost or the development times is difficult. Moreover, it is a very severe situation to realize the specification of MFT which a user can satisfy to the demand to high-performance-izing increasing day by day.

[0007] Furthermore, in order to explain in detail, the conventional joint network between each component was notionally shown in drawing 9. In the airline printer 92, in this drawing, image I/O device 93 contains [ data input output equipment 91 ] the image I/O device control section 931 including the data-input-output-equipment control section 911, including the airline printer control section 821. Each component of each other is combined, and printer ability will be realized if the association 94 of a data I/O component and a printing component becomes active. If similarly the association 95 of an image input component and a printing component is turned on and the association 96 of an image input component and a data I/O component will be turned on in the Copyer function again, a filing function will be realized respectively.

[0008] Although the conventional example explained the basic actuation in various services using drawing 7 - drawing 9, the communication link time amount of a control code and the transmission time of image data between each component pose a problem most in these actuation. Reservation of sufficient bandwidth for unification of the protocol of a control code to send a lot of data like image data in the transmission time of image data at high speed in the communication link time amount of a control code is because it is respectively inadequate.

[0009] With having only collected the control units of an independent device like before, and having constituted MFT, the improvement in the speed as MFT is difficult because of such a reason. Moreover, the new demand [ say / a high addition function or power saving ] which is not until now needs to correspond with the view which stood on an original configuration called MFT. That is, in having performed adjustment between each control section like before, it even becomes dangerous to cause increase of development cost and the development time and to realize a specification finally.

[0010] Moreover, out of the block diagram of the conventional MFT system of drawing 8, as conventionally shown in drawing 10, a data-input-output-equipment control section, an airline printer control section, and the image input device control section are roughly divided, and are constituted by two blocks, a microprocessor (it omits Following MPU) 101 and an application specific integrated circuit (it omits Following ASIC) 102. However, it is very difficult to adopt the flexibility of an addition and amelioration of a function promptly in the specification of MFT with such a configuration. It is because the architecture of these control sections cannot divide the assignment of software and hardware clearly and cannot change it.

[0011] Furthermore, increase of the clock frequency accompanying improvement in the speed is making the extraneous emission noise from a joint network increase. This originates in the switching current of the CMOS circuit which constitutes LSI. In recent years, it is required that EMC (Electro Magnetic Compatibility) should fully be considered in a system design from the rise of consciousness to an environmental problem. On the other hand, it is worried also about malfunction of the electronic system

by the electromagnetic wave noise with the spread of a pocket device or wireless LAN. Even if it is inevitable to become strong increasingly as for this flow and the high engine performance is obtained, it becomes impossible to take out as a product what cannot meet the opposite environment nature criteria to a commercial scene.

[0012] The solution approach for the conventional extraneous emission reduction has many elements depending on experience and admiration. That is, in the layout of the circuit used as a noise generation source, using trial-and-error or a simulator, an improvement is tried or various measures, such as covering the whole generating part of a radiated noise by metal shielding material, are taken. However, any approach is a symptomatic therapy-measure and, in many cases, has needed great time amount and cost. Moreover, the point that such extraneous emission could not necessarily be held down even on the target noise level had also not necessarily become the big cause which lowers the precision of a product-development plan.

[0013] This invention is for solving these troubles, and it aims at offering cheaply MFT which can output and input high-definition image data at a high speed within a short period of time. Furthermore, an unnecessary electromagnetic wave noise is not taken out to an external environment, but it aims also at suppressing low the susceptibility (EMS: Electro Magnetic Susceptibility) over an electromagnetic wave noise to coincidence.

[0014]

[Means for Solving the Problem] The data input output equipment which performs a print function in order to solve said trouble, The data I/O engine which has the control section of this data input output equipment, and the printing engine which has the control section of the airline printer which performs a copy function, and this airline printer, It has the image I/O engine which has the control section of the image I/O device equipment which performs image I/O functions, such as facsimile and filing, and this image I/O device. With each engine MFT of this invention which offers various services, such as a print function, a copy function, and an image I/O function The description is to have prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services. Therefore, it becomes possible to secure sufficient bandwidth which can receive and pass a mass data between each component at high speed like image data. Furthermore, offer \*\*\*\*\* also becomes easy by having a control device only for MFT at a user about a high addition function or the new service [ say / power saving ] which is not until now.

[0015] Moreover, when a bus switching control is a crossbar switch, since the bandwidth of a data bus can be made large and it connects by one to one, it becomes possible to raise a clock frequency.

[0016] Control instruction can be transmitted [ furthermore, ] and received between each component and the MFT control device within each component at a high speed, without suppressing small the circuit scale of the control device distributed in each component by being equipment which a control section reconfigures dynamically according to each service, and delaying a data transmission rate below to the maximum performance of a bus.

[0017] Moreover, the engine performance can be efficiently employed in the maximum, without spoiling the rapidity of a bus switching control, when the equipment reconfigured dynamically contains recon figure skating rubble logic.

[0018] Furthermore, most extraneous emission from a joint network is lost by constituting a joint network by optical bus. Moreover, being influenced [ most ] of the electromagnetic wave noise emitted from other systems is lost. That is, since it has the property which was extremely excellent respectively to EMC and EMS, malfunction of the equipment which does not do a bad influence to an external environment and originates in coincidence at an external noise is also lost.

[0019] Moreover, an optical bus can also lower the susceptibility from an external electromagnetic wave noise greatly while being able to reduce the extraneous emission from a joint network sharply by being used as a data bus which transmits image data.

[0020] Furthermore, it becomes easy to secure sufficient bandwidth which is a high speed, and receives a mass data like image data mutually, and can pass it according to the specification of an optical bus

being the same.

[0021]

[Embodiment of the Invention] MFT of this invention prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services.

[0022]

[Example] Drawing 1 is the block diagram showing the configuration of MFT concerning one example of this invention. In this drawing, the same reference mark as drawing 7 shows the same component. Sequentially from the hierarchy of a high order, the application layer 72, the controller layer 11, and the engine layer 71 were expressed, the application layer 72 and the controller layer 11 are APIs (Application Programming Interface) 12, and the controller layer 11 and the engine layer 71 are engine I/F 74, and they have touched respectively. And the application layers 72 are various services of the image I/O function 723 of others, such as a print function 721, a copy function 722, facsimile, and filing, the controller layer 11 is the MFT controller 13, and the engine layer 71 is constituted by each component, which are data input output equipment 711 and the data-input-output-equipment control section 731, an airline printer 712, the airline printer control section 732, image I/O device 713, and the image I/O device control section 733. Independently [ the application layer 72 to which specification modification takes place frequently by adopting such architecture, and the engine layer 71 with the high weight of a machine, optics, and the communication link field ], since development of the controller layer 11 is made to MFT of this example, big effectiveness is in it to improvement in development effectiveness, or compaction of verification time amount.

[0023] Drawing 2 is the block diagram showing the configuration which systematized MFT in this example. In this drawing, the MFT system of this example is constituted through the network 24 in MFT21, PC22 by the side of a host, and the server 23. MFT21 is constituted here including the control panel 25 prepared in order that each component, which are the MFT control device 211, data input output equipment 212, the data-input-output-equipment control section 213, an airline printer 214, the airline printer control section 215, image I/O device 216, and the image I/O device control section 217, and a user might operate MFT. A main function is achieved with the MFT control device 211, for example, the bus switching control 211-1 which consists of crossbar switches, and each component are connected by the specification defined identically preferably, for example, the dedicated bus specified by USB specification or IEEE1394 specification. And the MFT control device 211 is constituted including the bus switching control 211-1 and MPU 211-3 to which this bus switching control 211-1 is connected through the I/O section 211-2. On the other hand, the control unit put on each component is constituted by ASIC and MPU, and can assign an assignment of hardware processing and software processing suitably according to specifications required of a system, such as speed and image quality. Furthermore, it connects with a network 24 through data input output equipment 212, and MFT21 performs informational processing and are recording to PC22, a server 23, and mutual.

[0024] Here, MFT shown in drawing 1 or drawing 2 explains order for how various services which had the demand from the user are realized later on below.

[0025] First, the process which realizes the print function is explained briefly. The file created with the application software which operates on PC22 or the file saved on the server 23 in the form of the application proper, and these are translated, corrected and developed in printer language through a printer driver on PC22. The data after this expansion are described by the method of a printer language proper, and may be compressed by the original algorithm. Thus, the data for printers described in printer language via the network 24 from PC22 by the side of a host at the MFT21 side are sent. Next, the data for printers inputted into the data input output equipment 212 by the side of MFT21 are sent to the data-input-output-equipment control section 213. In the data-input-output-equipment control section 213, using the decoder prepared according to the class of printer language currently used, input data is interpreted and the data of the bit map format which an airline printer 214 finally needs are created. Furthermore, when compression processing is performed to data by the printer driver, the data-input-output-equipment control section 213 also performs expanding processing. Thus, the obtained

processing result is transmitted to the MFT control unit 211. Since the bus switching control 211-1 in the MFT control device 211 has secured the bus between the component of data I/O, and a printing component beforehand, the data sent from the data I/O component are transmitted to a printing component at a high speed. It cannot be overemphasized that this rate is the thing exceeding the processing speed of an imaging engine naturally. Then, the airline printer control section 215 performs image processings, such as color matching, according to the property of an airline printer 214, and rasterizes the received data on the imaging device which is finally an airline printer 214. Thus, printing of the target file is completed. The above is the process which realizes a print function.

[0026] Next, the process which realizes the copy function is explained briefly. In this case, according to conditions beforehand set up with the MFT control unit 211, such as resolution, and black and white/color, the image I/O device control section 217 makes the preparations which read a document. According to directions of the image I/O device control section 217, a manuscript is optically read using CCD or image sensors, and image I/O device 216 changes it into the electrical signal of an analog. And the signal is changed into digital image data by the A/D converter. In this way, the obtained processing result is transmitted to the MFT control unit 211. After that, hard copy is outputted from a printing component via the same processing as printer actuation.

[0027] Furthermore, in order to apply MFT to a filing system, the digital image data first obtained by the image input component is transmitted to the MFT control unit 21 like the time of copy actuation. Since the bus switching control 211-1 in the MFT control device 211 has secured the bus between an image input component and a data I/O component beforehand, the data sent from the image input component are transmitted to a data I/O component at a high speed. Then, compressive processing is performed to this data, and it is sent and saved from an I/O component at the server 23 on a network 24. Thus, filing of a document is completed.

[0028] Moreover, drawing 3 is the conceptual diagram having shown the joint network between each component in the MFT system of this example. In the airline printer 32, in this drawing, image I/O device 33 contains [ data input output equipment 31 ] the image I/O device control section 331 including the data-input-output-equipment control section 311, including the airline printer control section 321. Each component of each other is combined, and printer ability will be realized, if the association 34 of a data I/O component and a printing component becomes active as shown in (a) of drawing 3. If similarly the association 36 of an image input component and a data I/O component is turned on in a copy function as it is shown in (c) of drawing 3 again, if the association 35 of an image input component and a printing component is turned on as shown in (b) of drawing 3, a filing function will be realized respectively. Physical distance becomes [ association between the components which became active mutually ] short by unlike drawing 9 which showed the conventional example, having introduced the bus switching control 211-1 into the MFT control device 211, as shown in drawing 2.

[0029] The above is the structure of offer of the various services offered in MFT designed according to the configuration based on this example. It becomes possible to secure sufficient bandwidth which receives a mass data like image data at high speed, and can pass it with the control device of MFT by this example between each component, which are data input output equipment and a data-input-output-equipment control section, an airline printer and an airline printer control section, an image I/O device, and an image I/O control unit. And a user can use high-speed service by very easy actuation, without being conscious of MFT.

[0030] Moreover, drawing 4 is the block diagram showing the internal configuration in the control device which distributes and exists in each component in another example of this invention. Although it is conventionally constituted by two blocks, MPU and ASIC, as drawing 9 explained, the recon figure skating rubble logic 43 is used as a new module besides MPU41 and ASIC42 here. A different point from the example explained by drawing 2 is that ASIC in the control device which distributes and exists in each component is transposed to the thing containing the recon figure skating rubble logic 43. It is the greatest features that a functional change is made very much to a high speed, and this device is very useful in the application as which rapidity is required. That is, it can also have the flexibility of software processing, without losing the advantage of the rapidity which hardware processing has.



Consequently, hardware does not always need to have a large-scale circuit corresponding to all services, and should just reconfigure the contents of hardware in an instant according to the service used. Therefore, a required circuit scale can be sharply made small compared with the time of using conventional ASIC.

[0031] Here, recon figure skating rubble logic is explained briefly. This device has both advantages, such as the rapidity of hardware processing, and the flexibility of software processing, in coincidence, and the change to various functions is extremely performed at a high speed. In the application as which rewriting of a program takes time amount and rapidity is required with the conventional device, for example, FPGA, on the occasion of modification of this function, utilization was difficult. However, by recon figure skating rubble logic, it is the greatest features that this functional change is made very much to a high speed. Therefore, it is said that dynamic restructuring is possible for this device. As concrete structure or application, "the dynamic restructuring system of a programmable gate array" (JP,8-330945,A), "A Dynamically Reconfigurable Logic Engine with a Multi-Context/Multi-Mode Unified-Cell Architecture" (ISSCC99/Session21/Paper WA21.3), etc. are already announced. It cannot deny the processing by software that the appropriate merit is still fairly inferior as compared with hardware processing about the point of the rate which is one of the most important elements in the specification of MFT of a certain thing in the field of cost and flexibility. In MFT which deals with especially an image, there are very many amounts of data processing, and the present condition is that many parts for which it still depends on the force of hardware remain. On the other hand, although the processing by exclusive hardware, such as ASIC and FPGA, can respond to a certain limited processing at the speed which was very excellent, it is impossible to expect flexibility in essence. That is, the need that a user buys the new MFT itself depending on exchange of hardware or extension, and the case comes out [ amelioration of the present service, or an addition of new service ].

[0032] Furthermore, drawing 5 is the block diagram showing the MFT structure of a system in another example. In this drawing, the same reference mark as drawing 2 shows the same component. The MFT system shown in this drawing is an MFT system when only the data bus which transmits image data among the joint networks formed of interconnect between components is constituted by the optical bus in an MFT control device. Here, the optical buses 501, 502, and 503 are optical buses which transmit the image data in connection with each component, which are data input output equipment 211 and the data-input-output-equipment control section 213, an airline printer 214 and the airline printer control section 215, and the image I/O device 216 image I/O device control section 217, respectively. Moreover, the electrical signal buses 511, 512, and 513 are electrical signal buses which transmit the control code in connection with each above-mentioned component respectively. According to this example, the problem of a latency produced in the communication link of the control code which goes via an optical bus about which we are anxious by the high-speed system by which delicate timing is demanded is avoidable. Furthermore, while being able to reduce the extraneous emission from a joint network sharply by transposing the data bus which occupies the great portion of cause of extraneous emission to an optical bus, the susceptibility from an external electromagnetic wave noise can also be lowered greatly. If this point is explained to a detail, in the high-speed system by which delicate timing is demanded, the latency produced in the communication link of a control code may become a problem. That is because the time amount which changes it into a lightwave signal from the electrical signal from a lightwave signal or an electrical signal although the lightwave signal itself can disregard time amount a transfer lag total as a matter of fact has the time amount of a certain finite. The system for which high-speed actuation is needed very much enables it to attain requirement specification by leaving a control signal system with the conventional electrical signal to stop the latency of a control signal small. About extraneous emission, the effectiveness that an optical bus has a control system since there are quite few signal lines compared with a data system is hardly spoiled.

[0033] Drawing 6 is the block diagram showing the configuration of the interface section of the optical bus built in each component in the MFT system of drawing 5 . After the output signal from each component goes into the transmitting-side input terminal 610 of the interface section 61 and being changed into a serial signal from a parallel signal by the multiplexer 611, an electrical signal is changed

into a lightwave signal with laser diode 612. A lightwave signal lets the transmitting-side coupler 613 pass, and is sent to an optical bus from the transmitting-side output terminal 614. On the other hand, the input signal from an optical bus goes into the receiving-side input terminal 615, lets the receiving-side coupler 616 pass, and goes into a photodiode 617. After a lightwave signal is changed into an electrical signal and changed into a parallel signal from a serial signal by the demultiplexer 618 here, it is sent to each component from the receiving-side output terminal 619. According to this example, the functional separation between a component and an optical bus will become perfect. Embedded-ization of the interface section of the electron/light in an optical interconnection becomes the very important point, when realizing a ultra high-speed system.

[0034] as each example explained above, it can be alike, and the MFT system which is a high speed and can offer quality service can be efficiently designed and verified by easy actuation by introducing the control device only for MFT into MFT for a short period of time, and a product can be released in a commercial scene.

[0035] In addition, this invention is not limited to the above-mentioned example, and if it is the publication of an application for patent within the limits, neither deformation of a variety nor a replaceable thing can be overemphasized.

[0036]

[Effect of the Invention] The data I/O engine which has the data input output equipment which performs a print function, and the control section of this data input output equipment as explained above, The printing engine which has the control section of the airline printer which performs a copy function, and this airline printer, It has the image I/O engine which has the control section of the image I/O device equipment which performs image I/O functions, such as facsimile and filing, and this image I/O device. With each engine MFT of this invention which offers various services, such as a print function, a copy function, and an image I/O function The description is to have prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services. Therefore, it becomes possible to secure sufficient bandwidth which can receive and pass a mass data between each component at high speed like image data. Furthermore, offer \*\*\*\*\* also becomes easy by having a control device only for MFT at a user about a high addition function or the new service [ say / power saving ] which is not until now.

[0037] Moreover, when a bus switching control is a crossbar switch, since the bandwidth of a data bus can be made large and it connects by one to one, it becomes possible to raise a clock frequency.

[0038] Control instruction can be transmitted [ furthermore, ] and received between each component and the MFT control device within each component at a high speed, without suppressing small the circuit scale of the control device distributed in each component by being equipment which a control section reconfigurates dynamically according to each service, and delaying a data transmission rate below to the maximum performance of a bus.

[0039] Moreover, the engine performance can be efficiently employed in the maximum, without spoiling the rapidity of a bus switching control, when the equipment reconfigured dynamically contains recon figure skating rubble logic.

[0040] Furthermore, most extraneous emission from a joint network is lost by constituting a joint network by optical bus. Moreover, being influenced [ most ] of the electromagnetic wave noise emitted from other systems is lost. That is, since it has the property which was extremely excellent respectively to EMC and EMS, malfunction of the equipment which does not do a bad influence to an external environment and originates in coincidence at an external noise is also lost.

[0041] Moreover, an optical bus can also lower the susceptibility from an external electromagnetic wave noise greatly while being able to reduce the extraneous emission from a joint network sharply by being used as a data bus which transmits image data.

[0042] Furthermore, it becomes easy to secure sufficient bandwidth which is a high speed, and receives a mass data like image data mutually, and can pass it according to the specification of an optical bus being the same.



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TECHNICAL FIELD

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[Field of the Invention] About a compound machine, this invention provides a detail with various services, such as a printer, a copy, facsimile, and filing, and relates to the compound machine using the bus switching control which switches a joint network to a high speed.

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PRIOR ART

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[Description of the Prior Art] A compound machine (Multi Function Product: omit Following MFT) is equipment which makes it possible to realize various services, such as a print, a copy, facsimile, and filing, with one equipment by being constituted by each component, which are data input output equipment, an airline printer, and a picture input device, and combining them. There is a remarkable thing in the spread of office digitization or networks in recent years, and it is recognized that MFT has very high compatibility to such a trend. Moreover, the demand to the productivity drive of an office work piece is also becoming strong day by day. The shipment number of MFT is sharply extended reflecting the user who newly considers installation of MFT instead of independent devices, such as the conventional printer, a copying machine, and a scanner, under such a background having increased rapidly.

[0003] Conventionally, as shown in drawing 7, each control sections 731, 732, and 733 of the image I/O device of others, such as each component, which are data input output equipment 711, an airline printer 712, and image I/O device 713, data input output equipment which is an independent device, an airline printer, and a scanner, were diverted to development of such a control device of MFT as they were as equipment 71, i.e., an engine layer, before compound-izing. And various services of the image I/O function 723 of others, such as a print function 721, a copy function 722, facsimile, and filing, have been offered. Such a development approach which hardly changes to the case of an independent device did not have the need of newly developing the control unit for MFT, and the big problem was not produced when the need of MFT was still small.

[0004] The actuation in the case of using various services about the conventional MFT hereafter using drawing 8 which showed the conventional MFT structure of a system is explained briefly. In this drawing, the MFT system is constituted through the network 84 in MFT81 and the external memory sections 83, such as the host side PC 82 and hard disk drive equipment. According to the MFT system which has such a configuration, when using MFT81 as a printer first, the data outputted from the host side PC 82 are inputted into the data input output equipment 811 by the side of MFT81 through a network 84. The data which entered here are the data-input-output-equipment control section 812 of data input output equipment 811, and analysis of printer language, expanding of an image, etc. are performed and they are changed into raster data. Then, data are sent to the airline printer control section 814 of an airline printer 813, and image processings, such as color matching, are carried out, and, finally they are outputted as printed matter with an airline printer 813. Next, when using MFT81 as Copyer, according to conditions beforehand set up by the image I/O device control section 816 of image I/O device 815, such as resolution, and black and white/color, a document is read in image I/O device 815, and it is changed into digital image data. After that, hard copy is outputted from an airline printer 813 via the same processing as printer actuation. Furthermore, when applying MFT81 as a filling system, image I/O device 815 generates digital image data first like the time of the Copyer actuation. The data is sent to the data-input-output-equipment control section 812 of data input output equipment 811, and compressive processing is performed. Finally data are transmitted to the external memory section 83 connected to the network 84 via data input output equipment 811, and filing of a document is completed. The above is

the structure of the various service provisions performed in the conventional MFT.

[0005] By the way, to MFT, the request of colorization correspondence, improvement in the speed, low-pricing, high addition functionalization, power-saving, etc. is recently strongly brought near from the user. And it is thought that the development for the formation of MFT high performance will be accelerated further from now on.

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EFFECT OF THE INVENTION

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[Effect of the Invention] The data I/O engine which has the data input output equipment which performs a print function, and the control section of this data input output equipment as explained above, The printing engine which has the control section of the airline printer which performs a copy function, and this airline printer, It has the image I/O engine which has the control section of the image I/O device equipment which performs image I/O functions, such as facsimile and filing, and this image I/O device. With each engine MFT of this invention which offers various services, such as a print function, a copy function, and an image I/O function The description is to have prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services. Therefore, it becomes possible to secure sufficient bandwidth which can receive and pass a mass data between each component at high speed like image data. Furthermore, offer \*\*\*\*\* also becomes easy by having a control device only for MFT at a user about a high addition function or the new service [ say / power saving ] which is not until now.

[0037] Moreover, when a bus switching control is a crossbar switch, since the bandwidth of a data bus can be made large and it connects by one to one, it becomes possible to raise a clock frequency.

[0038] Control instruction can be transmitted [ furthermore, ] and received between each component and the MFT control device within each component at a high speed, without suppressing small the circuit scale of the control device distributed in each component by being equipment which a control section reconfigures dynamically according to each service, and delaying a data transmission rate below to the maximum performance of a bus.

[0039] Moreover, the engine performance can be efficiently employed in the maximum, without spoiling the rapidity of a bus switching control, when the equipment reconfigured dynamically contains recon figure skating rubble logic.

[0040] Furthermore, most extraneous emission from a joint network is lost by constituting a joint network by optical bus. Moreover, being influenced [ most ] of the electromagnetic wave noise emitted from other systems is lost. That is, since it has the property which was extremely excellent respectively to EMC and EMS, malfunction of the equipment which does not do a bad influence to an external environment and originates in coincidence at an external noise is also lost.

[0041] Moreover, an optical bus can also lower the susceptibility from an external electromagnetic wave noise greatly while being able to reduce the extraneous emission from a joint network sharply by being used as a data bus which transmits image data.

[0042] Furthermore, it becomes easy to secure sufficient bandwidth which is a high speed, and receives a mass data like image data mutually, and can pass it according to the specification of an optical bus being the same.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] According to the above-mentioned conventional MFT, by having diverted the control section of an independent device and having developed MFT for every model combining them, reduction of development cost or the development times is difficult. Moreover, it is a very severe situation to realize the specification of MFT which a user can satisfy to the demand to high-performance-izing increasing day by day.

[0007] Furthermore, in order to explain in detail, the conventional joint network between each component was notionally shown in drawing 9. In the airline printer 92, in this drawing, image I/O device 93 contains [ data input output equipment 91 ] the image I/O device control section 931 including the data-input-output-equipment control section 911, including the airline printer control section 821. Each component of each other is combined, and printer ability will be realized if the association 94 of a data I/O component and a printing component becomes active. If similarly the association 95 of an image input component and a printing component is turned on and the association 96 of an image input component and a data I/O component will be turned on in the Copyer function again, a filing function will be realized respectively.

[0008] Although the conventional example explained the basic actuation in various services using drawing 7 - drawing 9, the communication link time amount of a control code and the transmission time of image data between each component pose a problem most in these actuation. Reservation of sufficient bandwidth for unification of the protocol of a control code to send a lot of data like image data in the transmission time of image data at high speed in the communication link time amount of a control code is because it is respectively inadequate.

[0009] With having only collected the control units of an independent device like before, and having constituted MFT, the improvement in the speed as MFT is difficult because of such a reason. Moreover, the new demand [ say / a high addition function or power saving ] which is not until now needs to correspond with the view which stood on an original configuration called MFT. That is, in having performed adjustment between each control section like before, it even becomes dangerous to cause increase of development cost and the development time and to realize a specification finally.

[0010] Moreover, out of the block diagram of the conventional MFT system of drawing 8, as conventionally shown in drawing 10, a data-input-output-equipment control section, an airline printer control section, and the image input device control section are roughly divided, and are constituted by two blocks, a microprocessor (it omits Following MPU) 101 and an application specific integrated circuit (it omits Following ASIC) 102. However, it is very difficult to adopt the flexibility of an addition and amelioration of a function promptly in the specification of MFT with such a configuration. It is because the architecture of these control sections cannot divide the assignment of software and hardware clearly and cannot change it.

[0011] Furthermore, increase of the clock frequency accompanying improvement in the speed is making the extraneous emission noise from a joint network increase. This originates in the switching current of the CMOS circuit which constitutes LSI. In recent years, it is required that EMC (Electro Magnetic Compatibility) should fully be considered in a system design from the rise of consciousness to an



environmental problem. On the other hand, it is worried also about malfunction of the electronic system by the electromagnetic wave noise with the spread of a pocket device or wireless LAN. Even if it is inevitable to become strong increasingly as for this flow and the high engine performance is obtained, it becomes impossible to take out as a product what cannot meet the opposite environment nature criteria to a commercial scene.

[0012] The solution approach for the conventional extraneous emission reduction has many elements depending on experience and admiration. That is, in the layout of the circuit used as a noise generation source, using trial-and-error or a simulator, an improvement is tried or various measures, such as covering the whole generating part of a radiated noise by metal shielding material, are taken. However, any approach is a symptomatic therapy-measure and, in many cases, has needed great time amount and cost. Moreover, the point that such extraneous emission could not necessarily be held down even on the target noise level had also not necessarily become the big cause which lowers the precision of a product-development plan.

[0013] This invention is for solving these troubles, and it aims at offering cheaply MFT which can output and input high-definition image data at a high speed within a short period of time. Furthermore, an unnecessary electromagnetic wave noise is not taken out to an external environment, but it aims also at suppressing low the susceptibility (EMS: Electro Magnetic Susceptibility) over an electromagnetic wave noise to coincidence.

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**MEANS**

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[Means for Solving the Problem] The data input output equipment which performs a print function in order to solve said trouble, The data I/O engine which has the control section of this data input output equipment, and the printing engine which has the control section of the airline printer which performs a copy function, and this airline printer, It has the image I/O engine which has the control section of the image I/O device equipment which performs image I/O functions, such as facsimile and filing, and this image I/O device. With each engine MFT of this invention which offers various services, such as a print function, a copy function, and an image I/O function The description is to have prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services. Therefore, it becomes possible to secure sufficient bandwidth which can receive and pass a mass data between each component at high speed like image data. Furthermore, offer \*\*\*\*\* also becomes easy by having a control device only for MFT at a user about a high addition function or the new service [ say / power saving ] which is not until now.

[0015] Moreover, when a bus switching control is a crossbar switch, since the bandwidth of a data bus can be made large and it connects by one to one, it becomes possible to raise a clock frequency.

[0016] Control instruction can be transmitted [ furthermore, ] and received between each component and the MFT control device within each component at a high speed, without suppressing small the circuit scale of the control device distributed in each component by being equipment which a control section reconfigures dynamically according to each service, and delaying a data transmission rate below to the maximum performance of a bus.

[0017] Moreover, the engine performance can be efficiently employed in the maximum, without spoiling the rapidity of a bus switching control, when the equipment reconfigured dynamically contains recon figure skating rubble logic.

[0018] Furthermore, most extraneous emission from a joint network is lost by constituting a joint network by optical bus. Moreover, being influenced [ most ] of the electromagnetic wave noise emitted from other systems is lost. That is, since it has the property which was extremely excellent respectively to EMC and EMS, malfunction of the equipment which does not do a bad influence to an external environment and originates in coincidence at an external noise is also lost.

[0019] Moreover, an optical bus can also lower the susceptibility from an external electromagnetic wave noise greatly while being able to reduce the extraneous emission from a joint network sharply by being used as a data bus which transmits image data.

[0020] Furthermore, it becomes easy to secure sufficient bandwidth which is a high speed, and receives a mass data like image data mutually, and can pass it according to the specification of an optical bus being the same.

[0021]

[Embodiment of the Invention] MFT of this invention prepared the bus switching control switched to the joint network formed of each interconnect between the system control section and each control section for every engine in MFT which realizes various services according to various services.

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EXAMPLE

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[Example] Drawing 1 is the block diagram showing the configuration of MFT concerning one example of this invention. In this drawing, the same reference mark as drawing 7 shows the same component. Sequentially from the hierarchy of a high order, the application layer 72, the controller layer 11, and the engine layer 71 were expressed, the application layer 72 and the controller layer 11 are APIs (Application Programming Interface)12, and the controller layer 11 and the engine layer 71 are engine I/F74, and they have touched respectively. And the application layers 72 are various services of the image I/O function 723 of others, such as a print function 721, a copy function 722, facsimile, and filing, the controller layer 11 is the MFT controller 13, and the engine layer 71 is constituted by each component, which are data input output equipment 711 and the data-input-output-equipment control section 731, an airline printer 712, the airline printer control section 732, image I/O device 713, and the image I/O device control section 733. Independently [ the application layer 72 to which specification modification takes place frequently by adopting such architecture, and the engine layer 71 with the high weight of a machine, optics, and the communication link field ], since development of the controller layer 11 is made to MFT of this example, big effectiveness is in it to improvement in development effectiveness, or compaction of verification time amount.

[0023] Drawing 2 is the block diagram showing the configuration which systematized MFT in this example. In this drawing, the MFT system of this example is constituted through the network 24 in MFT21, PC22 by the side of a host, and the server 23. MFT21 is constituted here including the control panel 25 prepared in order that each component, which are the MFT control device 211, data input output equipment 212, the data-input-output-equipment control section 213, an airline printer 214, the airline printer control section 215, image I/O device 216, and the image I/O device control section 217, and a user might operate MFT. A main function is achieved with the MFT control device 211, for example, the bus switching control 211-1 which consists of crossbar switches, and each component are connected by the specification defined identically preferably, for example, the dedicated bus specified by USB specification or IEEE1394 specification. And the MFT control device 211 is constituted including the bus switching control 211-1 and MPU 211-3 to which this bus switching control 211-1 is connected through the I/O section 211-2. On the other hand, the control unit put on each component is constituted by ASIC and MPU, and can assign an assignment of hardware processing and software processing suitably according to specifications required of a system, such as speed and image quality. Furthermore, it connects with a network 24 through data input output equipment 212, and MFT21 performs informational processing and are recording to PC22, a server 23, and mutual.

[0024] Here, MFT shown in drawing 1 or drawing 2 explains order for how various services which had the demand from the user are realized later on below.

[0025] First, the process which realizes the print function is explained briefly. The file created with the application software which operates on PC22 or the file saved on the server 23 in the form of the application proper, and these are translated, corrected and developed in printer language through a printer driver on PC22. The data after this expansion are described by the method of a printer language proper, and may be compressed by the original algorithm. Thus, the data for printers described in printer

language via the network 24 from PC22 by the side of a host at the MFT21 side are sent. Next, the data for printers inputted into the data input output equipment 212 by the side of MFT21 are sent to the data-input-output-equipment control section 213. In the data-input-output-equipment control section 213, using the decoder prepared according to the class of printer language currently used, input data is interpreted and the data of the bit map format which an airline printer 214 finally needs are created. Furthermore, when compression processing is performed to data by the printer driver, the data-input-output-equipment control section 213 also performs expanding processing. Thus, the obtained processing result is transmitted to the MFT control unit 211. Since the bus switching control 211-1 in the MFT control device 211 has secured the bus between the component of data I/O, and a printing component beforehand, the data sent from the data I/O component are transmitted to a printing component at a high speed. It cannot be overemphasized that this rate is the thing exceeding the processing speed of an imaging engine naturally. Then, the airline printer control section 215 performs image processings, such as color matching, according to the property of an airline printer 214, and rasterizes the received data on the imaging device which is finally an airline printer 214. Thus, printing of the target file is completed. The above is the process which realizes a print function.

[0026] Next, the process which realizes the copy function is explained briefly. In this case, according to conditions beforehand set up with the MFT control unit 211, such as resolution, and black and white/color, the image I/O device control section 217 makes the preparations which read a document. According to directions of the image I/O device control section 217, a manuscript is optically read using CCD or image sensors, and image I/O device 216 changes it into the electrical signal of an analog. And the signal is changed into digital image data by the A/D converter. In this way, the obtained processing result is transmitted to the MFT control unit 211. After that, hard copy is outputted from a printing component via the same processing as printer actuation.

[0027] Furthermore, in order to apply MFT to a filing system, the digital image data first obtained by the image input component is transmitted to the MFT control unit 21 like the time of copy actuation. Since the bus switching control 211-1 in the MFT control device 211 has secured the bus between an image input component and a data I/O component beforehand, the data sent from the image input component are transmitted to a data I/O component at a high speed. Then, compressive processing is performed to this data, and it is sent and saved from an I/O component at the server 23 on a network 24. Thus, filing of a document is completed.

[0028] Moreover, drawing 3 is the conceptual diagram having shown the joint network between each component in the MFT system of this example. In the airline printer 32, in this drawing, image I/O device 33 contains [ data input output equipment 31 ] the image I/O device control section 331 including the data-input-output-equipment control section 311, including the airline printer control section 321. Each component of each other is combined, and printer ability will be realized, if the association 34 of a data I/O component and a printing component becomes active as shown in (a) of drawing 3. If similarly the association 36 of an image input component and a data I/O component is turned on in a copy function as it is shown in (c) of drawing 3 again, if the association 35 of an image input component and a printing component is turned on as shown in (b) of drawing 3, a filing function will be realized respectively. Physical distance becomes [ association between the components which became active mutually ] short by unlike drawing 9 which showed the conventional example, having introduced the bus switching control 211-1 into the MFT control device 211, as shown in drawing 2.

[0029] The above is the structure of offer of the various services offered in MFT designed according to the configuration based on this example. It becomes possible to secure sufficient bandwidth which receives a mass data like image data at high speed, and can pass it with the control device of MFT by this example between each component, which are data input output equipment and a data-input-output-equipment control section, an airline printer and an airline printer control section, an image I/O device, and an image I/O control unit. And a user can use high-speed service by very easy actuation, without being conscious of MFT.

[0030] Moreover, drawing 4 is the block diagram showing the internal configuration in the control device which distributes and exists in each component in another example of this invention. Although it

is conventionally constituted by two blocks, MPU and ASIC, as drawing 9 explained, the recon figure skating rubble logic 43 is used as a new module besides MPU41 and ASIC42 here. A different point from the example explained by drawing 2 is that ASIC in the control device which distributes and exists in each component is transposed to the thing containing the recon figure skating rubble logic 43. It is the greatest features that a functional change is made very much to a high speed, and this device is very useful in the application as which rapidity is required. That is, it can also have the flexibility of software processing, without losing the advantage of the rapidity which hardware processing has. Consequently, hardware does not always need to have a large-scale circuit corresponding to all services, and should just reconfigure the contents of hardware in an instant according to the service used. Therefore, a required circuit scale can be sharply made small compared with the time of using conventional ASIC.

[0031] Here, recon figure skating rubble logic is explained briefly. This device has both advantages, such as the rapidity of hardware processing, and the flexibility of software processing, in coincidence, and the change to various functions is extremely performed at a high speed. In the application as which rewriting of a program takes time amount and rapidity is required with the conventional device, for example, FPGA, on the occasion of modification of this function, utilization was difficult. However, by recon figure skating rubble logic, it is the greatest features that this functional change is made very much to a high speed. Therefore, it is said that dynamic restructuring is possible for this device. As concrete structure or application, "the dynamic restructuring system of a programmable gate array" (JP,8-330945,A), "A Dynamically Reconfigurable Logic Engine with a Multi-Context/Multi-Mode Unified-Cell Architecture" (ISSCC99/Session21/Paper WA21.3), etc. are already announced. It cannot deny the processing by software that the appropriate merit is still fairly inferior as compared with hardware processing about the point of the rate which is one of the most important elements in the specification of MFT of a certain thing in the field of cost and flexibility. In MFT which deals with especially an image, there are very many amounts of data processing, and the present condition is that many parts for which it still depends on the force of hardware remain. On the other hand, although the processing by exclusive hardware, such as ASIC and FPGA, can respond to a certain limited processing at the speed which was very excellent, it is impossible to expect flexibility in essence. That is, the need that a user buys the new MFT itself depending on exchange of hardware or extension, and the case comes out [amelioration of the present service, or an addition of new service].

[0032] Furthermore, drawing 5 is the block diagram showing the MFT structure of a system in another example. In this drawing, the same reference mark as drawing 2 shows the same component. The MFT system shown in this drawing is an MFT system when only the data bus which transmits image data among the joint networks formed of interconnect between components is constituted by the optical bus in an MFT control device. Here, the optical buses 501, 502, and 503 are optical buses which transmit the image data in connection with each component, which are data input output equipment 211 and the data-input-output-equipment control section 213, an airline printer 214 and the airline printer control section 215, and the image I/O device 216 image I/O device control section 217, respectively. Moreover, the electrical signal buses 511, 512, and 513 are electrical signal buses which transmit the control code in connection with each above-mentioned component respectively. According to this example, the problem of a latency produced in the communication link of the control code which goes via an optical bus about which we are anxious by the high-speed system by which delicate timing is demanded is avoidable. Furthermore, while being able to reduce the extraneous emission from a joint network sharply by transposing the data bus which occupies the great portion of cause of extraneous emission to an optical bus, the susceptibility from an external electromagnetic wave noise can also be lowered greatly. If this point is explained to a detail, in the high-speed system by which delicate timing is demanded, the latency produced in the communication link of a control code may become a problem. That is because the time amount which changes it into a lightwave signal from the electrical signal from a lightwave signal or an electrical signal although the lightwave signal itself can disregard time amount a transfer lag total as a matter of fact has the time amount of a certain finite. The system for which high-speed actuation is needed very much enables it to attain requirement specification by leaving a control signal



system with the conventional electrical signal to stop the latency of a control signal small. About extraneous emission, the effectiveness that an optical bus has a control system since there are quite few signal lines compared with a data system is hardly spoiled.

[0033] Drawing 6 is the block diagram showing the configuration of the interface section of the optical bus built in each component in the MFT system of drawing 5 . After the output signal from each component goes into the transmitting-side input terminal 610 of the interface section 61 and being changed into a serial signal from a parallel signal by the multiplexer 611, an electrical signal is changed into a lightwave signal with laser diode 612. A lightwave signal lets the transmitting-side coupler 613 pass, and is sent to an optical bus from the transmitting-side output terminal 614. On the other hand, the input signal from an optical bus goes into the receiving-side input terminal 615, lets the receiving-side coupler 616 pass, and goes into a photodiode 617. After a lightwave signal is changed into an electrical signal and changed into a parallel signal from a serial signal by the demultiplexer 618 here, it is sent to each component from the receiving-side output terminal 619. According to this example, the functional separation between a component and an optical bus will become perfect. Embedded-ization of the interface section of the electron/light in an optical interconnection becomes the very important point, when realizing a ultra high-speed system.

[0034] as each example explained above, it can be alike, and the MFT system which is a high speed and can offer quality service can be efficiently designed and verified by easy actuation by introducing the control device only for MFT into MFT for a short period of time, and a product can be released in a commercial scene.

[0035] In addition, this invention is not limited to the above-mentioned example, and if it is the publication of an application for patent within the limits, neither deformation of a variety nor a replaceable thing can be overemphasized.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the configuration of MFT concerning one example of this invention.

[Drawing 2] It is the block diagram showing the MFT structure of a system using MFT of this example.

[Drawing 3] It is the conceptual diagram having shown the joint network between each component in the MFT system of this invention.

[Drawing 4] It is the block diagram showing the internal configuration in the control device which distributes and exists in each component in another example of this invention.

[Drawing 5] It is the block diagram showing the MFT structure of a system in another example.

[Drawing 6] It is the block diagram showing the configuration of the interface section of the optical bus built in each component in the MFT system of drawing 5 .

[Drawing 7] It is the block diagram showing the configuration of the conventional MFT.

[Drawing 8] It is the block diagram showing the conventional MFT structure of a system.

[Drawing 9] It is the conceptual diagram having shown the joint network between each component in the conventional MFT system.

[Drawing 10] It is the block diagram showing the internal configuration in the control device which distributes and exists in each component in the former.

[Description of Notations]

11; A controller layer, 12; API, a 13; MFT controller, 21; MFT, 22 ;P C, 23; server, 31,212,711; [ Data input output equipment, ] 32, a 14,712; airline printer, 33,216,713; An image I/O device, 41; MPU, 42; ASIC, 43; Recon figure skating rubble logic, 61; interface section, a 211; MFT control device, 211-1; A bus switching control, A 213,311,731; data-input-output-equipment control section, a 215,321,732; airline printer control section, 217,331,733; images I/O device control section, a 501 - 503; light bus, 511-513; electrical signal bus.

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[Translation done.]

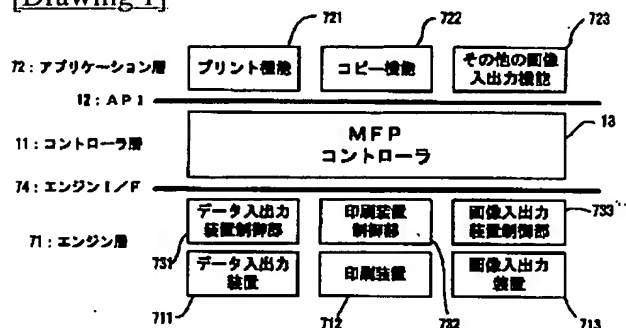
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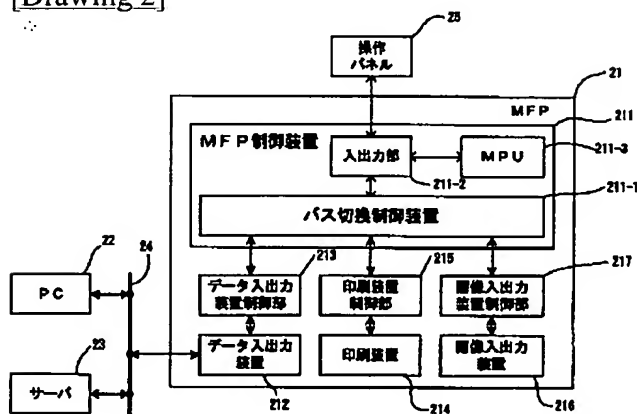
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## DRAWINGS

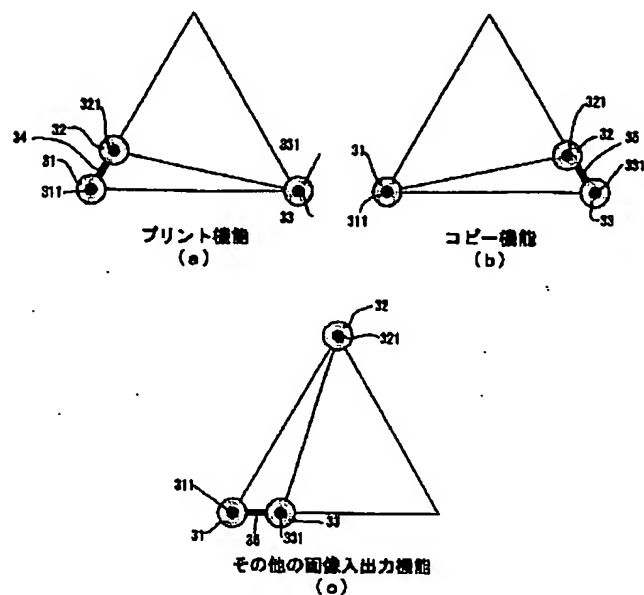
[Drawing 1]



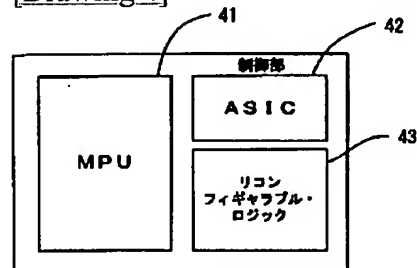
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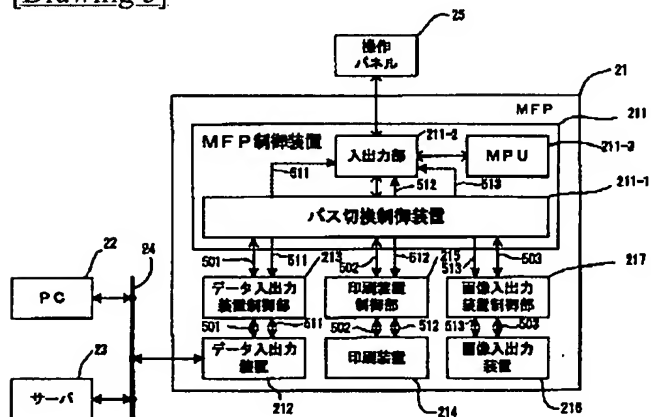
[Drawing 3]



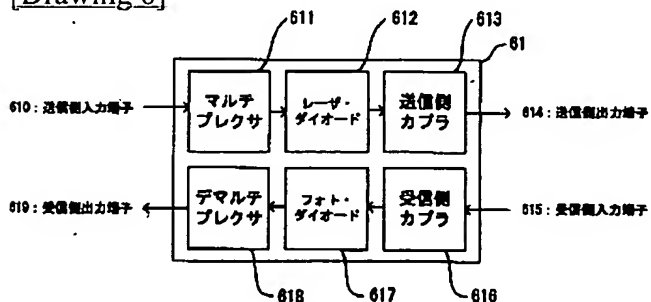
[Drawing 4]



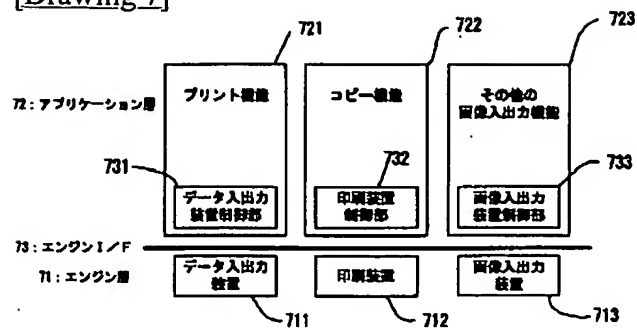
[Drawing 5]



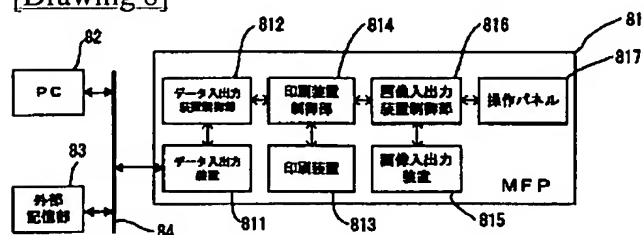
[Drawing 6]



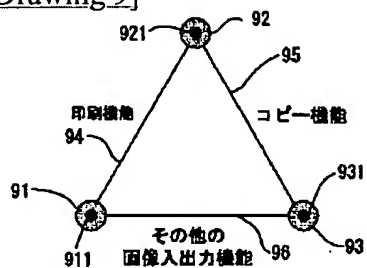
[Drawing 7]



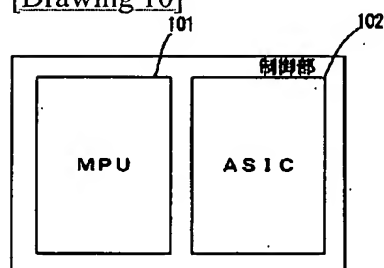
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]